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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/930,914	08/15/2001	Yoshihiro Yamaguchi	22837-06289	1691
758	7590	06/27/2005	EXAMINER	
FENWICK & WEST LLP SILICON VALLEY CENTER 801 CALIFORNIA STREET MOUNTAIN VIEW, CA 94041			FERRIS III, FRED O	
			ART UNIT	PAPER NUMBER
			2128	

DATE MAILED: 06/27/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/930,914

Applicant(s)

YAMAGUCHI ET AL.

Examiner

Fred Ferris

Art Unit

2128

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 07 April 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1,3-6 and 8-10 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1, 3-6, and 8-10 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 15 August 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 4/11/05.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

### DETAILED ACTION

1. *Claims 1, 3-6, and 8-10 are now pending in this application and have been presented for examination based on applicant's amendment filed on 7 April 2005. Applicants have cancelled claims 2, 7, and 11-15. Claims 1, 3-6, and 8-10 remain rejected by the examiner based on new grounds for rejection.*

### Response to Arguments

2. *Applicant's arguments filed 7 April 2005 have been fully considered.*

Regarding applicants response to objection to the specification: *The examiner withdraws the objection to the specification in view of applicants IDS submission and amendment to the specification filed 7 April 2005.*

Regarding applicant's response to 101 rejections: *Claims 1, and 3-5 remain rejected under 101 because as amended, the claimed limitations can still be carried out by a combination of a mental process and pencil and paper. (Please see: MPEP 2106) The examiner suggests that amending the preamble of claim 1 to recite "A computer implemented method for designing a shape of a blade..." would correct this deficiency.*

**MPEP 2111 [R-1]** *recites the following supporting rational:*

*"In re Prater, 415 F.2d 1393, 1404-05, 162 USPQ 541, 550-51 (CCPA 1969) (Claim 9 was directed to a process of analyzing data generated by mass spectrographic analysis of a gas. The process comprised selecting the data to be analyzed by subjecting the data to a mathematical manipulation. The examiner made rejections under 35 U.S.C. 101 and 102. In the 35 U.S.C. 102 rejection, the examiner explained that the claim was anticipated by a mental process augmented by pencil and paper markings. The court agreed that the claim was not limited to using a machine to carry out the process since the claim did not explicitly set forth the machine."*

*Claims 6 and 8-10 remain rejected under 101 because independent claim 6 does*

*not recite that the program stored on computer-readable medium achieves the desired result when executed on a computer processor. (Please see: MPEP 2106)*

*Regarding applicant's response to 102(b) and 103(a) rejections: The examiner withdraws the previous 102/103 rejections in view of applicant's amendment to the claims. However, while the previous arguments are now moot in view of new grounds for rejection, the examiner submits that the amendment to the claims has not overcome the anticipation of prior art Dennis et al as now cited below for the following reasons. First, the amended recitation of, "designing a shape of a blade having operational stability" is anticipated by Dennis because Dennis teaches designing a stable airfoil (blade) by multi-objective optimization. (i.e. the airfoils are in fact "blades" as used in a turbine design and directed toward effecting the "stability" of the blade design, see: Sections III-V. Figs. 1-10) Second, the amended recitation of objective functions including "at least one of" a trailing-edge deviation angel, pressure loss coefficient, maximum slop of blade surface Mach number, lift/drag ration, blade load, etc., is anticipated by Dennis because this limitation merely means that only one of such functions need be taught in the prior art. (see: Tables 1-3) Further, in describing "incidence toughness" page 9, line 1 of the specification recites; "it is sufficient to observe the degree of a change in the pressure loss coefficient occurring according to a change in inflow angle". Hence, there appears to be a functional equivalence between the claimed incidence toughness and the teachings of Dennis (see: page 3, section V, Tables 1-3) since Dennis clearly teaches using the inlet flow angle, inlet, and exit pressures incorporated within the objectives. In general, the claimed "objective*

*functions” are disclosed on page 8, line 16 of the specification appear to simply be the optimization of incidence toughness (taught by Dennis as noted above), pressure loss coefficient (average total pressure loss, taught by Dennis, Section V), and trailing edge deviation angle (i.e. exit flow angle, also taught by Dennis Section V, Tables 1, 2), and hence have been interpreted as such by the examiner and therefore remain anticipated by Dennis. Please see new 102(a) and 103(a) rejections below.*

### **Claim Rejections - 35 USC § 101**

35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

**3. Claims 1, 3-6, and 8-10 are rejected under 35 U.S.C. 101 because the claimed invention is drawn to non-statutory subject matter.**

*Specifically, claims 1-5 are not technologically embodied and merely recite “shape designing” that could be carried out by a combination of paper and pencil calculations and using mathematical abstract ideas. Claims 6-15 are directed to a “program” and “medium” that is intended to execute the method for the same limitations as claim 1 (i.e. using mathematical abstract ideas). The Examiner further submits that Applicant’s have not recited any limitations that provide a tangible result and have merely claimed a manipulation of abstract ideas realized as mathematical constructs. Section 2106 [R-2] (Patentable Subject Matter — Computer-Related Inventions) of the MPEP recites the following:*

*“In practical terms, claims define nonstatutory processes if they:*

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- consist solely of mathematical operations without some claimed practical application (i.e., executing a “mathematical algorithm”); or
- simply manipulate abstract ideas, e.g., a bid (Schrader, 22 F.3d at 293-94, 30 USPQ2d at 1458-59) or a bubble hierarchy (Warmerdam, 33 F.3d at 1360, 31 USPQ2d at 1759), without some claimed practical application.”

An invention which is eligible for patenting under 35 U.S.C. § 101 is in the “useful arts” when it is a machine, manufacture, process or composition of matter, which produces a concrete, tangible, and useful result. The fundamental test for patent eligibility is thus to determine whether the claimed invention produces a **“useful, concrete and tangible result.”** The test for practical application as applied by the examiner involves the determination of the following factors:

(1) “Useful” - The Supreme Court in *Diamond v. Diehr* requires that the examiner look at the claimed invention as a whole and compare any asserted utility with the claimed invention to determine whether the asserted utility is accomplished.

(2) “Tangible” - Applying *In re Warmerdam*, 33 F.3d 1354, 31 USPQ2d 1754 (Fed. Cir. 1994), the examiner will determine whether there is simply a mathematical construct claimed, such as a disembodied data structure and method of making it. If so, the claim involves no more than a manipulation of an abstract idea and therefore, is nonstatutory under 35 U.S.C. § 101. In *Warmerdam* the abstract idea of a data structure became capable of producing a useful result when it was fixed in a tangible medium which enabled its functionality to be realized.

(3) “Concrete” - Another consideration is whether the invention produces a “concrete” result. Usually, this question arises when a result cannot be assured. An appropriate rejection under 35 U.S.C. § 101 should be accompanied by a lack of

*enablement rejection, because the invention cannot operate as intended without undue experimentation.*

*The Examiner respectfully submits, under current PTO practice, that the claimed invention does not recite either a useful, concrete, or tangible result and is merely drawn to a manipulation of abstract ideas.*

- *The invention is not **useful** since independent claims 1, 6, and 11 do not recite a result that is useful in the technological art. This makes it difficult to determine Applicant's invention since it merely claims a manipulation of abstract ideas by optimizing objective functions and finding Pareto solutions. (The patent eligibility standard requires **significant functionality to be present to satisfy the useful result aspect** of the practical application requirement. See *Arrhythmia*, 958 F.2d at 1057, 22 USPQ2d at 1036.)*
- *The claims are not **tangible** since, for example, the results of the "trade-off relationship between objection functions is undefined. No tangible result is recited as a result of the consideration of the "trade-off relationship between objection functions (see independent claims 1, 6, and 11).*
- *The claims are not **concrete** because the results are not assured. For example, is a solution possible for any and all arbitrary inputs? (i.e. any objective function?)*

### **Claim Rejections - 35 USC § 102**

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

**4. Claims 1, 3, 4, 8, and 9, are rejected under 35 U.S.C. 102(b) as being anticipated by "Multi-Objective Optimization of Turbomachinery Cascades for Minimum Loss, Maximum Loading, and Maximum Gap-to-Chord Ratio", Dennis et al, 8<sup>th</sup> AIAA/NASA/USAF/ISSMO Symposium on MAO, AIAA 2000-4876, September 2000.**

Per independent claims 1, and 6: Dennis discloses the use of optimized objectives (i.e. functions, Tables 1-3, Sections III-V. Figs. 1-10) in optimization analysis where the optimization analysis is performed on objective functions using Pareto optimization inclusive of a Pareto solution found by trade-of relationships (Section VI) between the objectives. More importantly, Dennis specifically discloses Pareto ranking in the design of turbine compressor blade shapes (Sections III-V. Figs. 1-10). Further, the recitation of, "designing a shape of a blade having operational stability" is anticipated by Dennis because Dennis teaches designing a stable airfoil (blade) by multi-objective optimization. (i.e. the airfoils are in fact "blades" as used in a turbine design and directed toward effecting the "stability" of the blade design, see: Sections III-V. Figs. 1-10) Also, the recitation of objective functions including "at least one of" a trailing-edge deviation angel, pressure loss coefficient, maximum slop of blade surface Mach number, lift/drag ration, blade load, etc., is anticipated by Dennis because this limitation merely means that only one of such functions need be taught in the prior art. (see: Tables 1-3) Further, in describing "incidence toughness" page 9, line 1 of the



*specification recites; "it is sufficient to observe the degree of a change in the pressure loss coefficient occurring according to a change in inflow angle". Hence, there appears to be a functional equivalence between the claimed incidence toughness and the teachings of Dennis (see: page 3, section V, Tables 1-3) since Dennis clearly teaches using the inlet flow angle, inlet, and exit pressures incorporated within the objectives. In general, the claimed "objective functions" are disclosed on page 8, line 16 of the specification appear to simply be the optimization of incidence toughness (taught by Dennis as noted above), pressure loss coefficient (average total pressure loss, taught by Dennis, Section V), and trailing edge deviation angle (i.e. exit flow angle, also taught by Dennis Section V, Tables 1, 2), Further, since Dennis also considers the inlet and outlet airfoil angle (Section III), the teaching would obviously inherently provide a range of incident angles of 10 degrees or less as recited in dependent claims 4 and 9. Hence, Dennis explicitly or inherently teaches all of the claimed limitations of independent claims 1, 4, 9 and 6. (Claim 6 merely claims the computer program and medium for the same limitations as claim 1 and are therefore rejected using the same reasoning as noted above.)*

Per claims 3 and 8: *The examiner notes that the inlet flow angel (1.9 deg.), and the exit flow angle (-70 deg.), as recited in Section V, page 3 of Dennis, have angles that are opposite to each other, hence, Dennis teaches a first and second incident angle being opposite. . Further, the limitation "with respect to a design point of the blade", is anticipated by Dennis since the optimization is obviously directed toward optimizing the airfoil (blade) design to a particular objective (i.e. point or constraint)).*

***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

***5. Claims 5 and 10 are rejected under 35 U.S.C. 103(a) as being unpatentable over "Multi-Objective Optimization of Turbomachinery Cascades for Minimum Loss, Maximum Loading, and Maximum Gap-to-Chord Ratio", Dennis et al, 8<sup>th</sup> AIAA/NASA/USAF/ISSMO Symposium on MAO, AIAA 2000-4876, September 2000, in view of "An Updated Survey of GA-Based Multiobjective Optimization Techniques", C.A. Coello, ACM Computing Surveys, Vol. 32, No. 2, June 2000.***

*Regarding dependent claims 5, and 10:* *These claims merely claim the method, computer program, and medium for limitations relating to Pareto optimization by MOGA. As previously cited above, Dennis renders obvious the elements of the claimed limitations of independent claims 1, and 6.*

*Dennis does not explicitly disclose the elements relating to Pareto optimization by MOGA.*

*Coello teaches the use of Pareto optimization by MOGA (see: page 132, column 2, paragraph 4).*

*It would have been obvious to one having ordinary skill in the art at the time the claimed invention was made to modify the teachings of Dennis relating to optimized*

objective functions using Pareto optimization and trade-of relationships, with the teachings of Coello relating to Pareto optimization by MOGA, to realize the claimed invention. An obvious motivation exists since, in this case, the Dennis reference teaches to the Coello reference, and the Coello reference teaches to the Dennis reference. Specifically, both Dennis and Coello teach optimizing blade (airfoil) design by Pareto optimization of objective functions and are used in the same technical arena as noted above. Dennis teaches to Coello because Dennis discloses that such methods are used in compressor blade shape design (See: Dennis, Sections III-VI). Coello teaches to Dennis because Coello specifically discloses the optimization of airfoil (blade) aerodynamic properties using the Pareto optimization by MOGA. (See: Coello, page 132, column 2, paragraph 4) Further, the level of skill required by an artisan to realize the claimed limitations of the present invention is clearly established by both references. (See: Dennis/Coello, Abstracts) Accordingly, a skilled artisan having access to the teachings of Dennis and Coello, would have knowingly modified the teachings of Dennis with the teachings of Coello (or visa versa) to realize the claimed elements of the present invention and gain the advantage of reduced development time and cost.

### **Conclusion**

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP

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§ 706.07(a). *Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).*

*A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.*

*The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Careful consideration should be given prior to applicant's response to this Office Action.*

*U.S. Patent 6,606,612 issued to Rai et al teaches turbine blade design optimization.*

*"Multiobjective Optimization with Messy Genetic Algorithms", D.A. Van Veldhuizen et al, SAC 00', ACM 1-58113-239-5/00/003, ACM May 2000 teaches multiobjective optimization.*

*"Multidiciplinary Turbomachinery Blade Design Optimization", R. Dornberger et al, AIAA-2000-0838, AIAA 2000 teaches blade shape design using pareto optimization.*

*Any inquiry concerning this communication or earlier communications from the examiner should be directed to Fred Ferris whose telephone number is 571-272-3778 and whose normal working hours are 8:30am to 5:00pm Monday to Friday. Any inquiry of a general nature relating to the status of this application should be directed to the group receptionist whose telephone number is 571-272-3700. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Jean Homere can be reached at 571-272-3780. The Official Fax Number is: (703) 872-9306*

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June 15, 2005*

  
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